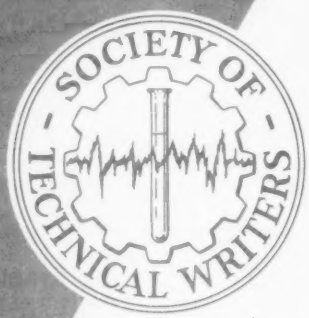
TECHNICAL WRITING REVIEW



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TECHNICAL WRITING REVIEW

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Toward More Useful Bibliographies

By Peter M. McLellan, Mem. STW
Project Editor
Department of Oceanography
University of Washington
Seattle, Washington

One of the weakest points in modern technical writing is found in the presentation of the bibliography. Any author or reader searching out references in different libraries will be aware of this bibliographic problem. Few actually consider the true magnitude of the problem and fewer still have made visible effort to correct it in their own work.

One of the reasons for the difficulty encountered in locating publications from bibliographic citations is that different systems of cross-reference are used in library card catalogs. The result of this variation in systems is that the reader searching out the author's references may not be able to locate them if all the necessary bibliographic information is not presented. Given all the necessary information, however, the reader may find the reference in any system of card cataloging. Complete bibliographic identification is especially necessary on obscure references, which, unfortunately, are often the most difficult to cite effectively and are the most difficult to locate. An absence of familiar bibliographic information, such as the title and the complete identification of the journal, should only mean that it was not present on the reference — not that it was omitted because of the author's mistaken belief that this information was unnecessary in locating the reference.

It is unfortunate that extreme abbreviation has become so widespread. The number of inches of text space saved is so far outweighed by the loss of valuable identifying information that many abbreviated references would be better omitted altogether. The various societies and organizations adhering to the style of extreme abbreviations appear to have lost sight of their own purposes of disseminating information concerning their special fields. This so-called "bibliographic jargon" actually keeps information from an interested layman who may himself be an expert in another equally significant line of study. The research writer will find that the abbreviated systems usually fall far short of their function when a particularly involved reference is to be cited. Either the bibliographic system breaks down to another method of entry, or all unconforming parts of the title and issuing organization are omitted.

REMEDIAL MEASURES

The contents and source of a reference in a bibliography should be quickly apparent and fully understood by any reader. Hence, the first requisite for every entry is that it should provide all the information necessary to aid in its location in as short a time as possible in any library system.

P. M. McLellan

Some rules for clarification of bibiliographic presentation are as follows:

1. Abbreviations should be extremely limited or not used at all.
2. There should be no question or possible misunderstanding of any of the parts of the reference.
3. The method of citation should be logical and consistent.
4. The most involved reference should readily fall into the adopted system.

The following system of notation is offered to authors who wish their bibliographies to conform with the foregoing rules. Although this bibliographic form is based on the "American Library Association Cataloging Rules for Author and Title Entries," the format has been changed slightly to meet more closely the needs of the technical report writer. This basic system is used by several scientific journals but, unfortunately, has not gained the wide recognition that it merits.

The form or style of this bibliography has proven especially useful in literature survey reports in which maximum clarity was required for a large number of references involving many types of entries. The entries are made alphabetically by author and chronologically for more than one entry by the same author. The title of the book, article, or chapter follows the date. The name of the journal, issuing organization, or publisher's name and location are next, followed by the volume, issue number, and pages or number of pages involved.

If the pages are dittoed, processed, or mimeographed, the designation may be made in parentheses directly following the number of pages or last entry in the citation. If the reference is an abstract, unpublished, or classified, the designation may be made following the last period of the entry. If two or more publications by one author for a given year are to be cited, they may be arranged alphabetically by title. This arrangement is demonstrated in section II, Articles, in the examples that follow.

The exact title of the publication should be given. Any abbreviation, misspelling, or odd punctuation should be carried as it is found. The spacing and punctuation used in the bibliography should be straightforward and consistent. Every effort should be made to avoid the trite but rarely understood Latin terms, ditto marks, and ellipses often found associated with bibliographical entries.

The examples that follow illustrate a simple and direct method of handling most types of citations:

I. BOOKS AND MONOGRAPHS

Seligman, G.
1931. Snow structure and ski fields. MacMillan and Co., London, 555 pages.

Official publication, one of a sequence
U. S. Navy, Office of the Chief of Naval Operations, Aviation Training Division
1951. How to survive on land and sea. The Naval Aviation Physical Training Manuals, United States Naval Institute, 340 pages.

Publication having an editor or chairman when there are many or no authors
Wright, E. W. (editor)
1895. Lewis and Dryden's marine history of the Pacific Northwest. Lewis and Dryden Printing Co., Portland, Oregon, 494 pages.

Chapter from a symposium volume
Church, Phil E.
1942. Climates of the Pacific Northwest. [In] The Pacific Northwest, [edited by] Otis W. Freeman and Howard H. Martin, John Wiley and Sons, New York, chapter 4, pp. 104-125.

Unpublished work, no date
Poulson, E. N., J. T. Miller, R. H. Fowler, and R. D. Flannery
n. d. Soil survey of King County, Washington. Manuscript on file at the Renton, Washington Office, U. S. Department of Agriculture, Bureau of Soils, 202 pages. (Unpublished.)

Unpublished work, no title, no date. Descriptive title supplied by the bibliographer
O'Brien, M. P.
n. d. [Oceanography of coastal harbors.] On file, U. S. Army, Corps of Engineers, Beach Erosion Board, Washington, D. C. (Unpublished.)

II. ARTICLES

Two publications by the same author for a given year
Church, Phil E.
1941a. The summer time vertical humidity gradient over the cold water of the San Juan Archipelago. Transactions of the American Geophysical Union, Part II, pp. 484-489.
1941b. Type curves and variability of annual snowfall: state of Washington. Transactions of the American Geophysical Union, Part I, pp. 159-170.

Identical article, authors, etc., published in two or more different publications, with different dates
Mangum, A. W. and party
1911. Reconnaissance soil survey of the eastern part of the Puget Sound Basin, Washington. U. S. Department of Agriculture, Bureau of Soils, 90 pages; also in — Field Operations of the Bureau of Soils, 1909 (printed in 1912), pp. 1517-1600.

III. NEWSPAPERS

Anonymous
1945. Fog dispelling program. The Humboldt Times, Eureka, California, Tuesday, October 2, 1945.

Author shown
Way, Dave
1947. Fog dispelling program, Landing Aids Station. The Humboldt Times, Eureka, California, Thursday, May 1, 1947.

Article published in newspaper, later mimeographed for private circulation by and from another organization
Anderson, Alvin
1950. Orders of the Director of Fisheries, General Order No. 256, State of Washington, Department of Fisheries. The Daily Olympian, Olympia, Washington, May 2, 1950; also available 1308 Smith Tower, Seattle 4, Washington, 121 pages (mimeographed).

IV. GOVERNMENT OR ORGANIZATION

Research publication giving author credit
Eisberg, H. B. and J. E. Owens
1949. Fundamentals of Arctic and cold weather medicine and dentistry. U. S. Navy Department, Bureau of Medicine and Surgery, Research Division, Project NM 013 009, NAVMED 1307, U. S. Government Printing Office, 204 pages.

Report of a government organization made to Congress by a congressional committee
U. S. Army, Corps of Engineers
1936. Humboldt Bay and Harbor, Calif. House of Representatives, Committee on Rivers and Harbors, Document no. 11, 75th Congress, 1st Session, 21 pages.

Project report, typewritten, unpublished
California State Department of Public Works, Division of Water Resources
1952. Report to North Coastal Regional Water Pollution Control Board on survey of waste discharge of Humboldt Bay and Fields Landing. Water Quality Investigations, Project Code Nos. 52-1-9 and 52-1-6, 5 pages and 15 plates (typewritten). (Unpublished.)

Report intended for administrative use only, mimeographed
Columbia Basin Inter-Agency Committee, Subcommittee on Water Pollution
1952. Inventory of published and unpublished sediment-load data and chemical analysis of surface waters in the Pacific Northwest, 1951, 44 pages (mimeographed). (For Administrative Use Only.)

Publication with a number of parts having an organization as author
U. S. Department of Agriculture, Weather Bureau
1936. Climatic summary of the United States. Section 1 — Western Washington. Government Printing Office, Washington, D. C., 38 pages.

V. REPORTS

Annual, on file in a library
Humboldt County Planning Commission
1931. Annual report Humboldt County Planning Commission, 1930-1931. On file, University of California Library, Berkeley, California, 12 pages (mimeographed).

Annual, with reference to the entire series of reports
U. S. Treasury Department, Bureau of Customs
Annual. Merchant vessels of the United States. Government Printing Office, Washington.

Commission, published in a serial publication showing a chairman as author
Lawson, Andrew C. (chairman)
1908. The California earthquake of April 18, 1906, report of the State Earthquake Investigation Commission. Carnegie Institution of Washington, Publication no. 87, vol. 1, part 1, pp. 1-254; vol. 1, part 2, pp. 255-451.

VI. PUBLICATIONS RESULTING FROM CONFERENCES OR MEETINGS

Abstract of paper printed in a journal, paper originally presented at a meeting.
Bretz, J. Harlen
1915. Pleistocene of Western Washington, Bulletin of the Geological Society of America, vol. 26, p. 131. (Abstract.)

Proceedings from a conference, article originally presented as a paper at a conference or meeting at a given time and place and later compiled and published at another time and place
Marmer, H. A.
1952. Changes in sea level determined from tide observations. [In] Proceedings of Second Conference on Coastal Engineering, Houston, Texas, November 1951, [edited by] J. W. Johnson, The Engineering Foundation, Council of Wave Research, pp. 62-67.

VII. FOREIGN

Chapter from a symposium volume
Seeger, Homer L.
1936. Die pazifische küstenstadt Seattle. [In] Amerikanische Landschaft, [edited by] Erich von Drygalski, Walter de Gruyther and Co., Berlin, pp. 466-530.

Book with chapter in English being cited
Waters, A. C. and Hollis D. Hedberg
1939. The North American Cordillera and the Caribbean Region. [In] Regionale geologie der erde, band 3, jüngere orogenetische zonen, Akademische Verlagsgesellschaft M.B.H., Leipzig, abschmitt IVa, pp. 1-54. (In English.)

International organization, journal published in a foreign country, with article cited being in English
Thompson, T. G. and I. Igelsrud
1937. The solubility of boron in the waters of the North Pacific. Association d'Océanographie Physique, Union Geodesique et Geophysique Internationale, Procès-Verbaux, no. 2, p. 155.

VIII. MAPS

Having title, date, and author known; published
Mason, W. A.
1952. Strandings and wrecks of vessels on the coasts of California, Oregon, and Washington [map]. San Pedro Blueprint Co., San Pedro, California.

Having title, date, and issuing organization known; unpublished
Washington State Toll Bridge Authority
1939. Tacoma Narrows bridge, Pierce County, Geological cross-section. P.W.A. Docket no. Wash. 1870-F. (Unpublished.)

IX. MISCELLANEOUS

Personal communication in which an organization is represented
Washington State Toll Bridge Authority
1951. Personal communication on drill cores in Puget Sound. Letter from Chas. E. Andrew, Chief Consulting Engineer, Tacoma, Washington, to Frank H. Wang, dated August 29, 1951.

Thesis
Stark, William J. and Donald R. Mullineaux
1950. The glacial geology of the city of Seattle. Thesis, University of Washington, Seattle, Washington, 87 pages.

Reprint. Portion of a publication showing that it has been reprinted from another title at a later date by the same author (or organization)
U. S. Department of the Interior, Geological Survey
1940. Summary of yearly discharge at gaging stations in Pacific Slope Basins in California. Reprinted from Geological Survey Water Supply Paper 881, Surface Water Supply of the United States, 1939, Part II, pp. 351-438.

Technical Report Writing in AD 97

By John A. Miller, Mem. STW

Publications Specialist

General Engineering Laboratory

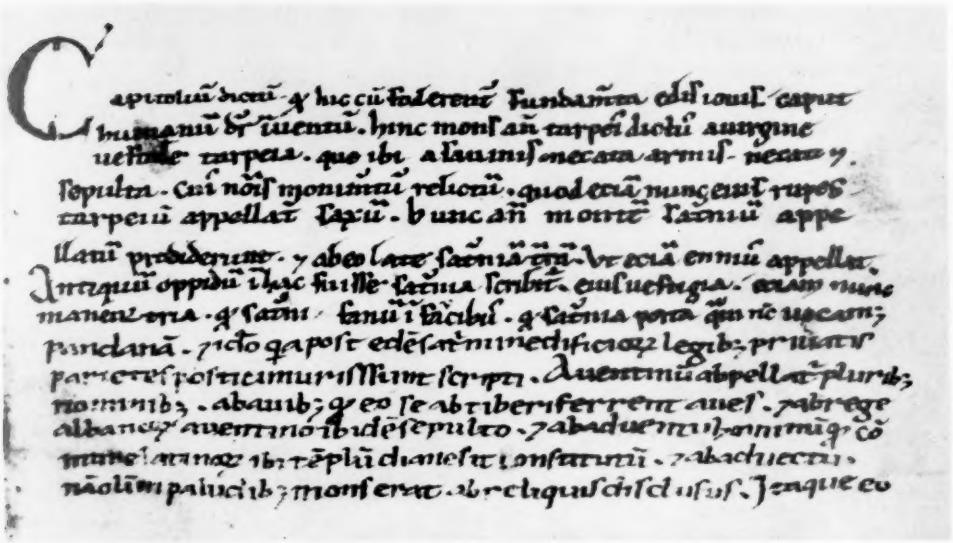
General Electric Company

A reform government headed by Nerva Augustus Caesar came into power in Rome in AD 96. One of the new emperor's first acts was to appoint Sextus Julius Frontinus to the post of Water Commissioner. This was an extremely important position, held only by leading citizens since the appointment many years earlier of M. Agrippa as the first Water Commissioner. Frontinus was a soldier and an engineer — a man of great energy, ability and integrity. He immediately undertook an investigation of the entire water supply system, and, in AD 97 reported his findings in a document of which any technical writer might well be proud.

Frontinus' report begins, as a good report should, with a clear statement of the purpose and scope of his investigation. The purpose, in brief, was to examine the whole situation with respect to the city's water supply and determine what improvements were needed. Continuing he says:

> "And that I may not by chance omit anything which is necessary for the understanding of the whole subject matter, I will first put down the names of the waters which are brought to the city of Rome; then by what persons, and under what consuls, and in what year since the founding of the city each of them was brought in; then at what places and at what mile-stones their aqueducts commence; how far they were carried in underground

After eighteen hundred and fifty years Frontinus' report on The Water Supply of the City of Rome is still an excellent technical report. Illustrated is the concluding paragraph as found in the Montecassino manuscript.



Courtesy Longmans Green & Company

channels, how far on masonry substructures, and how far on arches; then the height of each of them, and the size and number of taps, and what uses are dependent upon them; how much each aqueduct brings to each ward without the city, and how much within the city; how many public delivery tanks there are, and how much is delivered from them to the places of public amusement, how much to the ornamental fountains (munera) — as the more educated call them — how much to the water basins, how much to the use of the State (in the name of Caesar), how much for private uses by grants from the emperor; what is the law with regard to the construction and maintenance of the aqueducts; what penalties enforce it under laws, votes of the Senate, and Imperial edicts that have been enacted."

The matter of illustration received due consideration. He says:

"I also had plans made of the aqueducts, from which it may be seen where there are valleys and how wide they are, and where rivers have been crossed; also where the conduits laid on the hillsides need an extended and continued care for their protection and maintenance. In this way we reap the advantage of having, as it were, the works referred to directly before us, and of being able to study them, as though we stood by their side."

The water supply facilities of Rome at that time comprised a vast and complex system of aqueducts, underground mains, public fountains, and private metered service pipes. Some had been in use for a great many years. Others had been constructed at a later date. In accordance with his opening outline, Frontinus described each aqueduct clearly and listed the wards of the city which it served. Many parts of the system were in urgent need of repairs. Much of the necessity for repairs, the report stated, arose from "poor workmanship in the original construction, which has happened frequently in the case of recent work."

After describing at length the locations and histories of the various aqueducts, Frontinus proceeded to calculations of their flow, both at their sources and at the places where they entered the city. Large discrepancies were at once disclosed, far larger than could be accounted for by leakage or other normal causes. The reason was not hard to find. The report states:

"The cause of this is the fraud of the water-men, whom we have detected diverting water from the public conduits for private use; but a large number of proprietors of land also, whose fields border on the aqueducts, tap the conduits; whence it comes that the public watercourses are brought to a standstill by private citizens, yea, for the watering of their gardens."

Within the city, too, the Water Commission found much fraud which the report describes in considerable detail. Water was being supplied in many instances under forged names. "Shops, garrets, even, lastly, disorderly houses," he says, "have we found fitted up with constantly flowing fixtures." Many property owners had

J. A. Miller

tampered with the gages so that they received more water than they were entitled to.

The report charges the employees of the Water Department with another type of fraud called "tapping."

"Far away, and in all directions, run the pipes under the city pavements. I discovered that these pipes were furnishing water by special branches to all whom they passed and who had been able to arrange for it; being bored for that purpose here and there, by the so-called tappers; whence it came, that only a small quantity of water reached the places of public supply."

Having discussed the system as a whole and the abuses which he found in its operation, Frontinus proceeds to tell of the corrective measures he had put into effect. In the first place, he put his own house in order. The Water Commissioner, as befitted the holder of so important an office, had been authorized to employ a number of personal attendants and assistants — more, in fact, than were actually needed. Frontinus reports:

"Although the treasury has continued down to the present to pay for these attendants and servants, they have, as far as appearance goes, ceased to do any work on account of the laziness and negligence of the commissioners, who do not attend to their duties. But when the commissioners went out of the city, provided it was on official business, the lictors had to accompany them according to the commands of the Senate. In my examination of the aqueducts, my self-reliance and the authority given me by the sovereign will stand in place of the lictors."

He explains how he attacked vigorously the problems of unauthorized taps and inaccurate gages on the private service pipes. The former he caused to be removed and destroyed wherever found. The latter he replaced by new and accurate gages of the sizes specified in the property owners' water permits.

"It remains to speak of the maintenance of the conduits; but before I say anything about this, a little should be explained about the gangs of slaves employed upon them. There are two of those gangs; one belongs to the State, the other to Caesar. The one belonging to the State is the older, which, as we have said, was left by Agrippa to Augustus, and was by him made over to the State. It numbers about 240 men. The number in Caesar's gang is 460; it was instituted by Claudius at the time he brought his aqueduct into the city.

"Both gangs are divided into several classes of workmen: overseers, reservoir-keepers, line-walkers, pavers, plasterers, and other workmen; of these, some must be outside the city for purposes which do not require any great amount of work, but demand prompt attention; the men within the city at their stations at the reservoirs and fountains will devote their energies to the several works, especially in case of sudden emergencies, in order that a plentiful supply of water may be turned from several wards of the city to those which are threatened with deprivation. Both these large gangs, which occasionally were taken by exercise of favoritism or by negligence of their foremen for employment on private work, I resolved to bring back to some discipline and to the service of the State, by writing down the day before what each one was to do, and putting in the records what it had done each day."

In his conclusion, Frontinus pointed out that the people, by official vote in the Forum had passed a law imposing heavy fines on anyone who "after promulgation of this law, shall maliciously and knowingly pierce, break, or attempt to pierce or break, the canals, conduits, arches, pipes, drains, reservoirs, basins of the public water-supply, or who shall do damage with intent to diminish the water-courses, or portions of them, so as to prevent them from going, spreading, flowing, reaching, being conducted into the City of Rome," or so as to prevent proper distribution within the city.

But the Water Commissioner was dubious about the results to be achieved by the imposition of fines. In his closing paragraph he says:

"I should call the transgressor of so beneficient a law not unworthy of the threatened punishment. But those who have lived in an atmosphere of delusion, and to whom a violation of the law had become second nature in the course of time, had to be brought back to the right way of thinking by gentle means. I therefore endeavored with diligence that as far as possible the erring ones should remain unknown. Those who sought the Emperor's pardon, after due warning received, may thank me for the pardon granted. But for the future, I would wish that it might not be necessary to invoke the law, for it will be necessary to maintain the honor of my office even at the risk of giving offence."

Besides having the virtue of good organization, Frontinus' report is commendable for its conciseness. The oldest known copy of the report is, or was some years ago, to be found in the library of the monastery at Montecassino, Italy. This comprises 23 pages hand-lettered in Latin — few enough for so important a subject. The Montecassino manuscript is believed to have been copied during the twelfth century from a much earlier manuscript, perhaps even from Frontinus' original. But what is perhaps most noteworthy of all is the clarity of statement which can survive for eighteen hundred and fifty years and still present a perfectly understandable picture to readers living in a civilization undreamed of when the words were originally written. It takes a well-written report to stand that test.

Author's Note: The full text of the report is given in "Frontinus and the Water Supply of the City of Rome" by Clemens Herschel, published 1913 by Longmans Green & Company. Quotations are by permission of the publisher.

WRITING GUIDES DON'T TELL HOW TO WRITE

R. A. Sencer, Assistant Professor of English and Editor for the Research Division at Rensselaer Polytechnic Institute, has undertaken a study of what the professional societies of science and engineering require of their authors. Because much of the research work in technology is done for the federal government, he is collecting also from some of the larger governmental agencies.

Of the nineteen agencies and societies already having sent material, only three of them have shown any particular interest in the actual job of writing, according to Professor Sencer. He indicates that by far the greater majority of style manuals and instruction sheets are devoted to mechanical requirements such as general organization (preface, summary or abstract, discussion and theory, conclusions, etc.); page set-up including instructions for typists, margins, double or triple spacing, number of copies, etc.; standardization of abbreviations (within the particular organization only) and methods of using mathematical language.

Although there seems to exist very little instruction or guidance in the art of writing, three authorities are listed by some of the editors as being the outstanding guides to good writing: *The United States Government Printing Office Style Manual* (1953), the style manual of the University of Chicago, and *Webster's New International Dictionary* (6th edition). Even when these sources are examined carefully, however, one can see that much of the material in them is still devoted only to the mechanics of writing. Professor Sencer has indicated his concern about this lack of attention to the serious problem of writing itself and has suggested that there is a need for more and more good material on the art of writing.

Let's Review the Fundamentals

By C. R. Hammond

Emhart Manufacturing Co.

Hartford, Conn.

Editor's note: Every year dozens of articles on technical writing appear in engineering magazines. Each attempts to provide a new slant — "Technical Writing Can Be Effective", "Don't Write Reports, Engineer Them", "Engineers Can Write Better", "Writing Reports That Get Action", etc., etc. Yet when all is said and done, the fundamentals remain the same. This article presents no revolutionary ideas. The author has set down the simple rules and hints that have helped his co-workers in preparing acceptable reports.

The primary purpose of a technical report is to furnish sufficient information so that decisions can be reached and action taken. In the case of experimental investigations, the report becomes a document considerably more systematic and intelligible than the original notebook memoranda — the only organized record left to the company for the large sums spent on research and development.

Since the report is to convey information clearly and logically to others for immediate and future use, the writer must have a complete grasp of the investigation and the results obtained. The report should be written in brief and simple language, with well-constructed sentences and short, everyday words, except when accuracy demands the use of technical terms.

Each part of a report has an important function in making the presentation complete. Taken together, the parts should provide the answers to the following questions:

Why has this work been done?

What work was done and what were the results?

What do the results *mean?*

What *action* do these results suggest?

The outline given below can be used to organize a report on almost any investigation, no matter how complex or theoretical it may be.

(a) INTRODUCTION
Review of background information, objective, and literature review.

(b) PROCEDURE AND RESULTS
Brief description of what was done and what results were obtained. The results should be limited to the most important data.

(c) CONCLUSIONS AND RECOMMENDATIONS
Significance of results, conclusions to be drawn (if any), and recommendations for future work.

(d) EXPERIMENTAL SECTION
Methods, materials, special apparatus, tests and analyses, discussion and evaluation of results, special procedures, tables and graphs. This section should contain an account of the work in such detail that it can be checked or repeated at a later date.

The advantage of this outline is that the first three sections, taken together, form a complete unit and tell the entire story in a brief but comprehensive way. The Experimental Section contains supplementary details. This arrangement allows the report to be considered by persons only mildly interested, or who have insufficient time for reading the entire report. Readers who wish to check the accuracy of the report, or who wish to repeat the experimental work must refer to the latter part.

It is helpful to label the four basic parts of the report, particularly if the report is long. Additional clarity can be obtained through use of subheadings. Usually, the order of presentation is not the order in which the report is prepared. The Experimental Section will probably be assembled first, then the Procedure and Results, next the Conclusions, and finally the Introduction. The sections can then be arranged in proper sequence.

ABSTRACT

It is desirable that each report be preceded by an abstract. The abstract not only helps those people who have insufficient time to read the whole report, but it also assists in locating technical information in the files. These abstracts may be typed separately and circulated to executives and other employees. For this reason, clarity and compactness are essential. The abstracts should be easily understood by persons unfamiliar with the technical aspects of the investigation.

Each abstract should contain the following:

(a) An introduction, correlating the present report with previous reports or earlier work.
(b) A summary of the present report.
(c) An outline of future work planned, if any.
(d) A statement of any patent action that may have been taken.

The abstract must be kept short. The shorter it is, the more difficult it is to write. In general, the abstract should not exceed a half-page or a page in length at the most.

REFERENCES AND FILING REPORTS

Much duplication can be avoided if references are adequately and properly cited. Whenever possible, all reports should be completely referenced to correlate

present work with previous investigations. References made to technical literature should follow a standard abbreviated form. In cases where the number of references is large, it is best to place a bibliography at the end of the report, after the Experimental Section. Superscripts may be used throughout the report to refer to bibliographic material.

NOMENCLATURE

Care should be taken in the choice of words used in reporting. Frequently, vernacular terms come into use in industrial plants. The natural tendency to carry these words over into scientific writing should be avoided.

Loosely used terms are responsible for much of the confusion that exists in filing material, and much more trouble is caused than is generally realized. If possible, adopt a single term and be consistent. While there may be little difficulty to the author or to the readers of reports, trouble does arise in filing such material and in relocating information.

Specific terms should be used in place of indefinite terms. For example, it is better to use the chemical names, sodium hydroxide, sodium bicarbonate, sodium carbonate, sodium nitrate, or sodium oxide, in place of the more indefinite term "soda."

TRADE NAMES

Trade names should always be accompanied by identifying information. Unless the author gives a clue as to the type of product, composition, or manufacturer, the reader is often unable to obtain any information about a trade name. Frequently there are two or more products with identical trade names, which leads to confusion. The author should never assume his readers are familiar with trade names.

Names of companies should be written out in full. For example, it is not sufficient to refer to Chicago belts when one means belts manufactured by the Chicago Rubber and Mfg. Co. Because of the enormous number of companies with almost identical names, they must be carefully identified.

TABLES, GRAPHS, DRAWINGS, AND PHOTOGRAPHS

The purpose of a tabulation is to enable the reader to see more clearly relationships which may not be noticeable in unclassified data, and to facilitate the presentation of facts.

The title of a table should be chosen so as to name precisely the contents of the table. All columns and rows should have clear, concise headings. "Table I" is an insufficient heading. "Column 2" or "Row 3" are also inadequate headings. It should be assumed that the reader of a report should be able to remove the table from a report and still know all about it.

All data to be considered at one time should be put into one table. Irrelevant facts which are unrelated to the central idea result in confusion, loss of emphasis, and give an impression of hasty and careless preparation.

As valuable as tabular arrangements may be, graphic presentation is even more effective. Graph papers are available with many types of grids. The author should become familiar with the advantages and disadvantages of each, so that he can use the one which will represent his data most effectively. Frequently, for example, semilogarithmic paper will give a much clearer picture of the data than a simple numerical grid.

Data plotted on graph paper fall into one of three types:

(a) An observed relationship giving a point-by-point plot of the data obtained by experiment or investigation.

(b) An empirical relationship giving a curve that reflects the author's interpretation of his series of observations, without a point-by-point plot of the observed values, or

(c) A theoretical relationship giving a curve alone or a curve accompanied by a point-by-point plot of observed values to show consistency of observation with theory.

The report should indicate clearly which of these three kinds of relationship is presented. This is particularly important for types (b) and (c), if observed points are not plotted.

Graphs should not be plotted if there are insufficient significant data. The so-called "three-point graphs" are always regarded with suspicion.

Photographs should always be made to illustrate apparatus in the best possible manner. It is desirable to label the parts before taking the photograph.

A drawing of apparatus or a flow sheet may materially improve the clarity of a report. If apparatus is shown in such a drawing, all parts should be clearly numbered to correspond with the description in the text.

ABBREVIATIONS AND SYMBOLS

Abbreviations may be used for common units, but it is not generally advisable to use abbreviations in the text of a report or in the abstract unless they are accompanied by figures, as for example, 100 gm., 25cc., 75°C. In giving temperatures always follow the number by F., C., R., or K. to indicate the scale used.

When two numbers occur next to each other, one expressing quantity and the other expressing size, the first should be written as a word instead of as a number to avoid possible confusion. For example: "Two 50cc. flasks."

If there is any doubt about a reader's ability to understand an abbreviation, it should be written out. For example, most readers would not know that r.m.s. stands for root mean square.

It is better to write out feet or inches instead of using ′ or ″.

Webster's Unabridged Dictionary should be consulted for proper abbreviation forms.

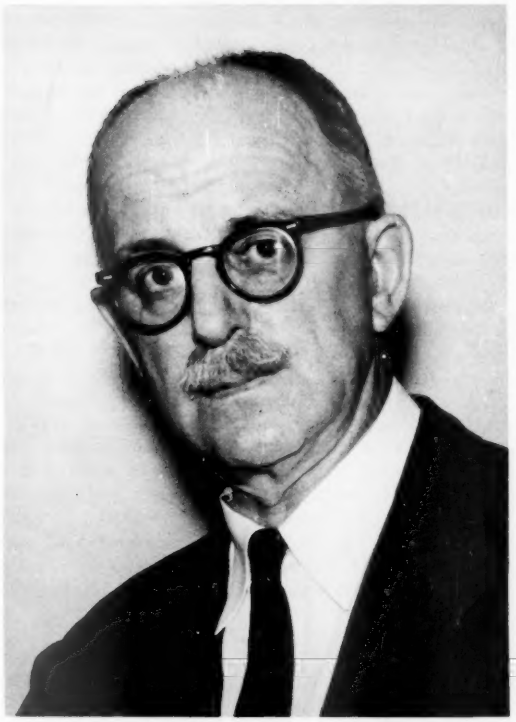
SIZE AND BINDING OF REPORTS

All reports should be of uniform size, 8½ x 11 inches, and should be typed on a good quality of paper. Graphs and tables, if oversize, should be folded into the report.

If possible, reports should be bound along the left margin so that they open up like a book. Bound in this manner, they are easier to read, and they file more readily, either in loose-leaf binders or in file cabinets.

Derivation of the Readability Formulas

By Professor Chris Sanford, Mem. STW
Rensselaer Polytechnic Institute
Troy, New York



Prof. Chris Sanford

The readability formulas referred to here are Rudolf Flesch's "Reading-Difficulty" Formula or "Yardstick," first brought to general attention in his *Art of Plain Talk* (1946); and the "Reading-Ease" and "Human-Interest" Formulas given in his *Art of Readable Writing* (1949).

Practising writers and editors have given the readability formulas a mixed reception. Some — perhaps unduly influenced by Flesch's vigorous presentation of their own ideas about popular writing — appear to swear by the formulas, often seeing in them far more than their author intends. Others — perhaps resenting the idea that any mechanical formula could replace their own hard-won experience and judgment — appear rather to swear at them, particularly delighting to find examples to which rigid application of the formulas gives an absurd result.

The purpose of this discussion is to describe briefly the reasoning and experiments from which Flesch derived his formulas. The account to be given is thought to be fair and reasonable. Comments, based on comparison with the original papers, will be most welcome.

THE READING-DIFFICULTY FORMULA

The scientific basis of the Reading-Difficulty Formula is explained in Flesch's PhD thesis, published in 1943 by The Teachers College of Columbia University (1). The thesis includes the material of a paper written by Flesch in 1941, and later published in *The Journal of General Psychology* (2).

A suitable starting point for this discussion is *The McCall-Crabbs Standard Test Lessons in Reading* (7). These Standard Test Lessons consist of 376 pages of graded difficulty, designed for testing school children's reading comprehension. A correctly graded child should answer 50 percent of the test questions correctly. The Standard Test Lessons do not go beyond Grade Seven, since the rigid procedure required is not acceptable to older children.

The purpose of Flesch's research was to establish a style-element formula for grading the difficulty of adult reading-matter, to be used, for example, in selecting texts for Adult Education classes. He established a satisfactory formula by means of three experiments: on magazine articles, on the Standard Test Lessons, and on magazines.

The reading of certain types of magazines provides an index of the socio-economic and educational levels of the readers; and a rating of magazines by type of reader corresponds closely with their rating by "cultural value," according to a panel of 44 judges. (Flesch gives an array of authority for these statements.) Flesch's First Experiment was accordingly designed to show how typical magazines, at different levels of readership, resembled or differed from the Standard Test Lessons in their style-elements.

He took for his experiment 21 magazines, at five progressive levels of general quality and literary style: ranging from that of the movie, detective, confession-type magazines through a middle level (that of THE READERS DIGEST) to the level of magazines presenting scholarly, academic writing (FOREIGN AFFAIRS, for example). From a random-selected recent issue of each magazine he took at random five factual articles; and

from each article he took at random three 100-word passages. He thus had 375 examples, 75 at each level.

In each of the samples, he counted the style-elements: (a) Average *Sentence-Length* in words, (b) *Prepositional Phrases,* (c) *Difficult Words* (as defined in an accepted standard list), (d) *Abstract Words* (defined at some length), (e) Prefixes, Suffixes, and Inflections (hereafter called *Affixes Etc.*). Statistical analysis of the data obtained, with known similar data (for three of the five style-elements) on the Standard Test Lessons, gave results summarized as follows:

(a) Average *Sentence-Length* showed the lower magazine levels closely related to the higher-grade Standard Test Lessons; and increased significantly through the magazine levels.

(b) The frequencies of *Prepositional Phrases* and *Difficult Words* did not vary significantly in the magazine levels.

(c) The frequencies of *Abstract Words* and *Affixes Etc.* showed significant, and statistically similar, increases through the magazine levels.

From his First Experiment, Flesch concluded that *Sentence-Length* certainly, and both *Abstract Words* and *Affixes Etc.* probably, would be suitable factors in a formula for grading difficulty in adult reading-matter. Since, however, the two last named gave practically identical measures of the same quality, "abstractness," he decided to abandon the factor *Abstract Words,* which was the more difficult to define and apply.

HUMAN INTEREST FACTOR

He now considered a new factor for his formula, one that should measure human interest. Earlier workers had measured the frequency of personal pronouns in the Standard Test Lessons, and had found that it had no worthwhile significance. Yet human interest obviously adds to the appeal of a piece of writing and reduces its reading difficulty. Flesch decided to experiment with a third factor, the frequency of *Human-Interest Words,* defined as: "All references to persons either by names or by words meaning persons as such or their mutual relations."

In his Second Experiment, Flesch counted the proposed new factors, *Affixes Etc.* and *Human-Interest Words,* in the Standard Test Lessons, and determined their respective relations with the grades. He found that both factors varied statistically with the grades: *Affixes Etc.* increasing and *Human-Interest Words* decreasing in frequency with increased difficulty of the Test Lessons.

Flesch now had available:

(a) His own data on the relation between *Sentence-Length* (sl) and difficulty in magazine articles: tying in with known data on that relation in the Standard Test Lessons.

(b) His own data on that relation for *Affixes Etc.* (af), both in magazine articles and in the Standard Test Lessons.

(c) His own data on that relation for *Human-Interest Words* (hw) in the Standard Test Lessons.

By mathematical treatment of his data Flesch obtained an intermediate formula (hereafter referred to as Formula Ix): $d = 0.1338sl + 0.0645af - 0.0659hw + 4.2498$

The object of Flesch's Third Experiment was to establish the real meaning of d in its higher values — i.e. in application of Formula Ix to more adult reading-matter.

The results of the tests for the Third Experiment are displayed in a table giving, for each magazine level, the estimated correction required to make d show the lowest educational level at which such magazines are widely read. The level typified, for example, by TRUE STORY has both a raw and a corrected value for d of 6.0 - 6.9. But the raw score of 10.0 - 10.9 of magazines at the level of THE YALE REVIEW would have to be corrected to read 13.0 - 16.9, since such magazines are read only by persons of the level of college undergraduates or better.

In his Third Experiment, Flesch distinguished six revised magazine levels. The least difficult, typified by the confession-type magazines, had a value for d of 6.0 - 6.9. The most difficult, typified by some scientific and professional journals, had a value for d of 11.0 or more. To these six levels he adds, in the *Art of Plain Talk,* a least difficult level of all, typified by the children's comics with a value for d of 5.0 - 5.9.

A real meaning for the higher values of d is now apparent.

Above 5.0, d shows both relative difficulty and the lowest level of education at which extensive adult readership is found. From 5.0 to 7.9, that information is expressed in terms of completed single school grades Four, Five and Six. Above 7.9, however, it is expressed in terms of wider ranges of educational attainment:

at 8.0 to 8.9	the level of high-school lower-classmen
at 9.0 to 9.9	the level of high-school upper-classmen
at 10.0 to 10.9	the level of college undergraduates.
above 11.0	the level of college graduates.

The intermediate Formula Ix covered the whole range of reading difficulty. But Flesch was concerned only with grading material for adult reading, not with grading material used below Grade Five. (The U. S. Census rates as "functionally literate" only persons who have attained the equivalent of passing Grade Four.) In order to make Formula Ix handier for his purposes, he accordingly rewrote it, subtracting 5.000 from the constant at the end. He thus obtained: $D = 0.1338sl + 0.0645af - 0.0659hw - 0.7502$.

Applied to a piece of writing above the difficulty level of Grade Four, the re-written formula (hereafter called Formula I) will give a positive "difficulty score" lying between 0 and 7. Thus the children's comics, understandable to a person of the lowest level of functional literacy, will now have a difficulty score of less-than-1. A typical article from THE READERS DIGEST will now have a middling difficulty score of 3.0 - 3.9 in a scale of 7, instead of its former rating of 8.0 - 8.9 in a scale of 12.

Formula I, with its final term reduced to but two significant figures, is the Reading-Difficulty Formula or "Yardstick" given in *The Art of Plain Talk.*

NEW FORMULAS SELECTED

Flesch's reasons for dropping the Reading-Difficulty Formula, and his derivation of the new Reading-Ease and Human-Interest Formulas, are set forth in a paper he wrote in 1947 and published in THE JOURNAL OF APPLIED PSYCHOLOGY (3).

Since its publication in 1943, Formula I had been made a basis for staff instructions in several governmental and other institutions, had been applied in a large variety of situations, and had been the subject of several validation studies (4). Extensive use of the formula had shown that it had certain shortcomings.

In particular, the factor *Affixes Etc.* had been found difficult to use — and indeed, a count of "affixes etc." based on principles, in a situation not covered by the particular examples given in Flesch's instructions, would require a considerable knowledge of philology. The *Human-Interest Words* factor was not generally understood and was often misapplied. As a result *Sentence-Length,* the one factor easily understood and applied, was frequently over-emphasized, or even considered alone without reference to the other factors.

It has been mentioned that in his Second Experiment, on the Standard Test Lessons, Flesch had accepted another worker's figure for the statistical relation between *Sentence-Length* and the proper grade for a child answering 75 percent of the test-questions correctly in a McCall-Crabbs test. An error was later discovered in that worker's computations, and was duly acknowledged (6). The discovery came too late, however, to prevent the error's appearing in Flesch's formula — in the one factor that users of the formula tended to overemphasize.

Again, the formula did not accurately show the effect on readability of conversational passages, and frequently led to unlikely-looking results when material containing such passages was compared with plain expository writing.

Finally, users of the formula reported difficulty in interpreting results expressed in terms of reading difficulty, in which a high score denoted low merit; and generally considered that they could make better use of a formula showing relative reading ease, with a high score the desideratum.

NEW FACTORS AND DEFINITIONS

Flesch accordingly decided to try the effect of two new factors: (a) Average *Word-Length* in syllables, tentatively replacing the factor *Affixes Etc.,* and obviously easier to work with; and (b) Frequency of *Personal Sentences,* a factor intended to test conversational quality and story interest; "personal sentences" being defined as: "Spoken sentences, marked by quotation marks or otherwise; questions, commands, requests, and other sentences directly addressed to the reader; exclamations; and grammatically incomplete sentences whose meaning has to be inferred from the context."

He retained the factor of average *Sentence-Length* in words, which had been found especially significant in his own and others' previous work. He also retained the factor of *Human-Interest Words,* but with a clarified definition, *Personal Words*: "All nouns with natural gender; all pronouns except neuter pronouns; and the words 'people' (used with the plural verb) and 'folks'."

Having arrived at his new list of style-elements, Flesch now counted them in the Standard Test Lessons and analyzed the results (again accepting published data for the actual count of *Sentence-Length,* but re-computing the correction to 75 percent performance). The figures showed: (a) that replacement of the factor *Affixes Etc.* by the new factor *Word-Length,* and the new definition of *Personal Words,* made no statistically significant difference; (b) that a formula based on the four factors now considered would have no better prediction value than Formula I; (c) but that the new factor *Personal Sentences,* taken by itself, would have a high prediction value.

THE NEW FORMULAS

Flesch, therefore, worked out from his data two separate intermediate formulas (not here reproduced). One showed the effect of the two "complexity" factors, *Word-Length* (wl) and *Sentence-Length* (sl) on reading difficulty as denoted by the grades of the Standard Test Lessons. The other showed the observed relation between decreasing frequency of the two "human-interest" elements, *Personal Words* (pw) and *Personal Sentences* (ps), and advancing the grades of the test lessons.

In order now to obtain formulas more convenient for general use, Flesch transformed the intermediate formulas algebraically, making a higher score correspond with a lower Test-Lesson grade — i.e. denote greater reading ease (instead of greater reading difficulty) or a higher frequency of the human-interest elements. He then adjusted the coefficients and constants: (a) so that either formula would give a score of 90 - 100 points to a Standard Test Lesson in which a Grade-Five child should answer 75 percent of the test-questions correctly; and (b) so that a difference in score of 10 points would represent one school grade. He thus obtained formulas (hereafter called Formulas II and III):

R. E. = 206.835 — 0.846wl — 1.015sl
H. I. = 3.635pw + 0.314ps

These are the Reading-Ease and Human-Interest Formulas given in *The Art of Readable Writing.*

Formula II — A score of 70 - 79 by Formula II indicates material easy enough to be understood by a person who has passed Grade Six but has not passed Grade Seven. A score lower than 70 indicates less-easy material, calling for some higher level of education.

Formula III — A score of 100 by Formula III indicates a frequency of the human-interest elements (named in the formula), suitable to the reading habits and skill of a Grade-Five child. A score of zero indicates only a complete absence of those elements. Applied to a Standard Test Lesson, the formula measures only the effect of human interest on the child's COM-

PREHENSION. Applied to a magazine article, however, it provides an index of a reader's MOTIVATION, first in selecting an article to be read, and then in deciding to continue reading it. Formula III can thus be most helpful to an editor choosing material for publication.

COMMENTS

Readability formulas, even when based on scientific research, are not necessarily infallible. Psychologists, like other scientists, are prepared to change their ideas after further research and experience. Flesch has himself recently proposed a new "experimental" formula, entirely different from his older formulas (5).

Flesch's accomplishment lies less in the actual formulas than in his effectively bringing the SCIENCE of readability to general attention. Before *The Art of Plain Talk* was published, few technical writers or editors even knew of the existence of a body of devoted scientists applying statistical methods to problems of writing and editing. Today, we are all at least aware of the scientific approach to our work.

Much of the current criticism of the readability formulas is based on a misconception of what Flesch claims for them. Some critics, for example, apparently fail to realize that the formulas are meant to be applicable only to raw copy — not to the material as it is presented to the reader. The formulas deal only with the style of the writing; and do not profess to cover other matters affecting readability, such as actual subject matter, quality of illustrations, layout and the like.

Again, a critic will sometimes show two pieces of writing, say a learned treatise and a textbook written for adolescents, that the formulas will put in the obviously wrong order. But Flesch does not claim that his formulas are always right. See, for example, in the Preface to *The Art of Plain Talk,* and similarly in *The Art of Readable Writing*: "What I hope for are readers who won't take the formula too seriously and won't expect from it more than a rough estimate." He might have done well to indicate how rough an estimate, so avoiding some unreasonable criticism that has appeared in print.

Valid objection might be raised to Flesch's implied assumption that *whatever is, is right.* But the English language, and publishing techniques, and public taste in reading-matter at all levels, are not static. HARPER'S was a successful magazine a century ago, although its style was very different from that of any popular magazine today. A brief examination of an early issue of TIME or LIFE will show how those magazines, successful in the 1930 s, have changed style in twenty or so years of successful operation. Flesch's formulas record the magazine-writing styles that were successful, at their various readership levels, in the 1940's.

The point is of more than academic importance. The present interest in readability formulas, with their suggestion of inherent authority, has tended to formalize popular writing. But we have no reason to suppose that the development of the language, and the almost whimsical process of change in public taste, have come to a dead stop. A formula based on analysis of currently successful writing can perhaps help a writer or editor judge and improve the present effectiveness of his work. Formula or no formula, he must always give first consideration to his readers' own ideas of what they want, lest he be left behind when fashion changes.

Today's cute YOU HAVE TO OIL THE WORKS! HERE'S HOW will surely be as much out-of-date tomorrow as yesterday's LUBRICATION INSTRUCTIONS is out-of-date today.

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(3) Flesch, R. "A New Readability Yardstick." J. APPL. PSYCH., 1948, V. 32, No. 3, pp. 221-233

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(6) Lorge, I. "The Lorge and Flesch Readability Formula: A Correction." SCHOOL AND SOCIETY, 1948, V. 67, pp. 141-2

(7) McCall, W. A. and Crabbs, Lelah M. *Standard Test Lessons in Reading.* Bur. Pub. Teachers Coll. Columbia Univ., 1926

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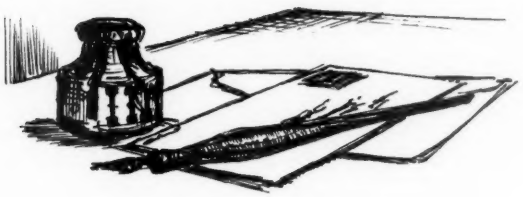

LETTERS FROM READERS

To the Editor:

Any professional society has in part the purpose of recognizing its members for their contribution to the advancement of the profession. In this sense, the length of time a man has been a member of the society is of no importance whatever. It is, however, in this sense that graded membership is of great importance in recognizing a member for his professional achievements.

Within the society itself, a member may be recognized for his efforts toward the advancement of the society by several means such as: 1) election to high office, 2) honorary certification, or 3) by any device employed by a group to honor a member for exceptional service to the society.

Hence there are two points to consider in recognizing the stature of a society member. The first, his stature in the profession, is almost universally recognized in a professional society by employment of graded membership. The second, his stature in the society, may be a very small part of his professional achievement, and his contributions to the advancement of the society should not be considered in determining his grade of membership. These points are to me by tradition and evolution implied in the use of the term "professional society."

KENNETH A. YOUNG, Mem. STW
MEDFORD, MASS.

To the Editor:

May I compliment you on the steady improvement in the TECHNICAL WRITING REVIEW. I particularly enjoyed the current issue. The filler item on page 33 "Technical Writer's Lament" adds an effective touch of humor; with your permission, we would like to reprint this choice bit of light verse in our mimeographed Station newsletter.

The poem reminds me of one I wrote recently:

WRITER'S CRAMPS

Long hours I must labor and strain.
I am weary and wracked with dull pain.
Though I question its worth,
I'm relieved to give birth
To this masterpiece child of my brain.

ELMER W. SHAW, Mem. STW
FORT COLLINS, COLO.

To the Editor:

I note in your spring issue that you have published a quatrain. This tickles me, both the verse (which is good, though untitled), and the fact that you are imaginative and resourceful enough to spice the REVIEW's inherently staid contents with an occasional chuckle.

Of course I am prejudiced. As a technical writer who likes to take a busman's holiday from the stern polysyllabics of my profession by driving through the calm countryside of light verse, I have been writing the stuff for years.

I shall now get to the matter at hand, namely the enclosed verse. It is a pleasant little parody on a Phyllis McGinley epic. I think you'll enjoy it. If you can find a place for it in the REVIEW, go right ahead. Meanwhile keep up the good work.

SONG OF THE TECHNICAL WRITER

To be sung in six-part harmony by a chorus consisting of engineers, editors, illustrators, photographers, printers and the Chief of the Bureau of Aeronautics.

CHORUS: Science's child is a man of mind,
An erudite individual,
To whom the brainwork is assigned
And writing's just residual.
Science's child can shape the earth
From Tennessee's hills to the Tiber.
Science's child has untold worth
Providing he has a transcriber.

Reports shall be submitted not later than the fifth of the month following the period reported on.

The world awaits a wonderland,
The product of the slide rule,
Ralph Waldo's "better mousetrap" and
The brand new bonafide rule.
But I must patiently implore,
Exhort, cajole and so forth
Until (excuse the metaphor)
The words begin to flow forth.
CHORUS

Tables and graphs shall be clear and uncluttered, with the meanings of all symbols carefully and completely explained.

Technicians all go home on time
To their cozy five-room ranches
To trim their trees in the outdoor clime
And prune off broken branches,
But five o'clock is the hour my desk
Is stacked with several strata
Of sketches cryptic and grotesque
And hieroglyphic data.
CHORUS

Text shall be so written that technical terms requiring a specialized knowledge shall be avoided.

The Sales Department deals in sales,
Accounting deals in dollars,
While writing technically entails
The abstruse wares of scholars.
They pledge themselves to progress, seek
New facts, are glad to die for 'em,
But since their statements sound like Greek,
Yours Truly must decipher 'em.
CHORUS

JOHN W. FALLON
NASHUA, N. H.

PROGRESS REPORT ON STANDARDIZATION

The American Standards Association, through report MC 3526, has released information on the work of Technical Committees of the International Standards Organization (ISO/TC) for the period November 1, 1954 to May 15, 1956.

Technical writers, editors, scientists, and engineers will be especially interested in the work of ISO/TC 12 on quantities, units, symbols, conversion tables and conversion factors; ISO/TC 37 on Terminology (principles and coordination); ISO/TC 46 on Documentation; and ISO/TC 10 on Drawings (General Principles).

These international standards groups, which represent 37 active member countries including the USA, meet periodically to draft recommendations and standards to be adopted by the international council.

ISO/TC 37 met in October 1954 in Vienna, Austria. Organization of a US advisory group is being undertaken by the ASA. July 23-24 of this year were scheduled for the next meeting of ISO/TC (Terminology) in Geneva.

ISO/TC 12 met in Copenhagen, June 20-24, 1955 and approved a document entitled "Fundamental Quantities and Units of the MKSA-System and Quantities and Units of Space and Time." Other Documents are in preparation.

Two ISO/TC 46 (Documentation) recommendations were published during the past year: ISO/R 8 — Layout of Periodicals, and ISO/R 9 — Transliteration of Cyrillic Characters. Recommendation ISO/R 18, entitled "Short Contents List" was approved by the Council in December 1955. A plenary meeting of ISO/TC 46 is scheduled for August 30-September 1, 1956, at Stuttgart, Germany. ASA sectional committee Z 39 is arranging USA representation for this meeting. Additional information on the progress of this work in standards can be obtained through the American Standards Association, Inc., 70 E. 45th Street, New York 17, N. Y. (rdMc)

New Amendments To STW Constitution

The STW National Tellers Committee has announced that the recent vote on two proposed amendments (Amendments 2 and 3) to the STW Constitution resulted in overwhelming approval of both amendments. These amendments are:

Amendment 2 —

Article III, Section 3, Paragraph (b).

Formerly:

"(b) Members and Associate Members shall be entitled to national voting privileges beginning six months after their election to membership."

Now becomes:

"(b) Members and Associate Members shall be entitled to national voting privileges upon their election to membership and the payment of the current appropriate dues."

Amendment 3 —

Article XII, Section 3, last line.

Delete the words "June 1, 1956." Add the words "June 1, 1957, and until their successors are elected and take office."

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Joint STW and TWE Convention Tentative Program

A recent meeting of the joint program committee for the combined STW and TWE fall convention met recently and outlined a tentative program. As now envisaged it will cover a two-day meeting, November 15 and 16, and will include both formal speakers and discussion sessions. The convention will be held at Hotel Statler, New York City. The program outlined below gives proposed topics only, since at this time final commitments for speakers has not been made.

Thursday morning, November 15.

Theme: What Is Expected of Technical Writers.

"What the Armed Forces Expects of Technical Writers."

"What Management Expects of Technical Writers."

"What Engineer Readers Expect of Fellow Engineers who Write."

Thursday afternoon, Alpha Section

Theme: Improving Technical Writing Performance

Panel —

"On-the-job training — by employee — by employer."

"Formal Training Programs."

Discussion

Beta Section

Theme: Producing and Organizing Engineering Literature for Effective Use.

Panel —

"Lessons in Visual Aids from the Caveman."

"Keeping Production Costs down in Technical Publications."

"Adapting Technical Literature to the Objectives of Libraries."

Discussion

Friday afternoon, Alpha Section

Theme: Being Specific about Instruction Manuals.

Panel —

"Techniques of Gathering Raw Materials for Military Manuals."

"Editing to Meet the Wants of the Engineers and the Needs of the Customer.'

"Techniques of Preparing Commercial Manuals."

Discussion

Beta Section

Theme: Being Specific about Industrial and Government Engineering Writing.

Panel —

"Approaches to Scientific Writing."

"Copy for Industrial Reports."

"Copy for Scientific Journals."

Discussion

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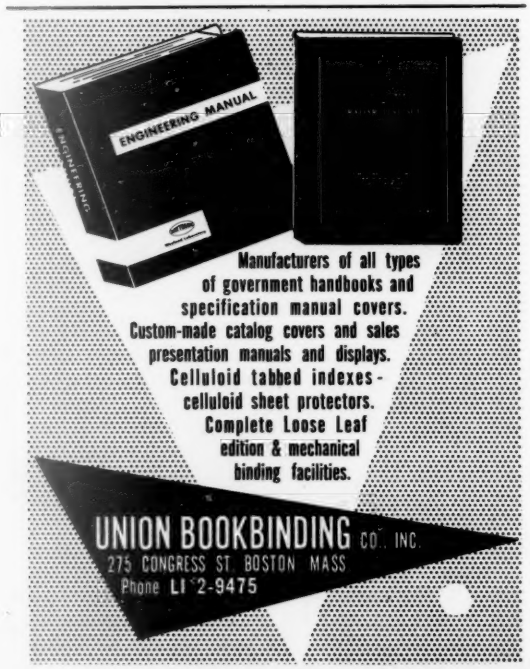
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